Economic Externalities of Inland Navigation

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Evaluation of Navigation Projects is Evolving

- Broadening
- Stimulated by Stakeholder Involvement
- Environmental interests want to include dredging, exotic species, changes in hydrology
- Industry proponents want to include lower air emissions, relief of road congestion, fewer accidents and noise

Objectives of this effort

- Review literature on modeling and measuring the externalities of the various modes of freight transportation
- Air emissions/health impacts (main focus)
- Congestion
- Accidents
- Externalities specific to water transport

Externalities: Societal Costs that are not reflected in market transactions

External Costs of Freight Transport in Europe

- Euro per Ton-Kilometer
- Road 71
- Rail 19
- Waterborne 17
- Includes accidents, noise, air pollution, climate change (but not congestion)

European Developments

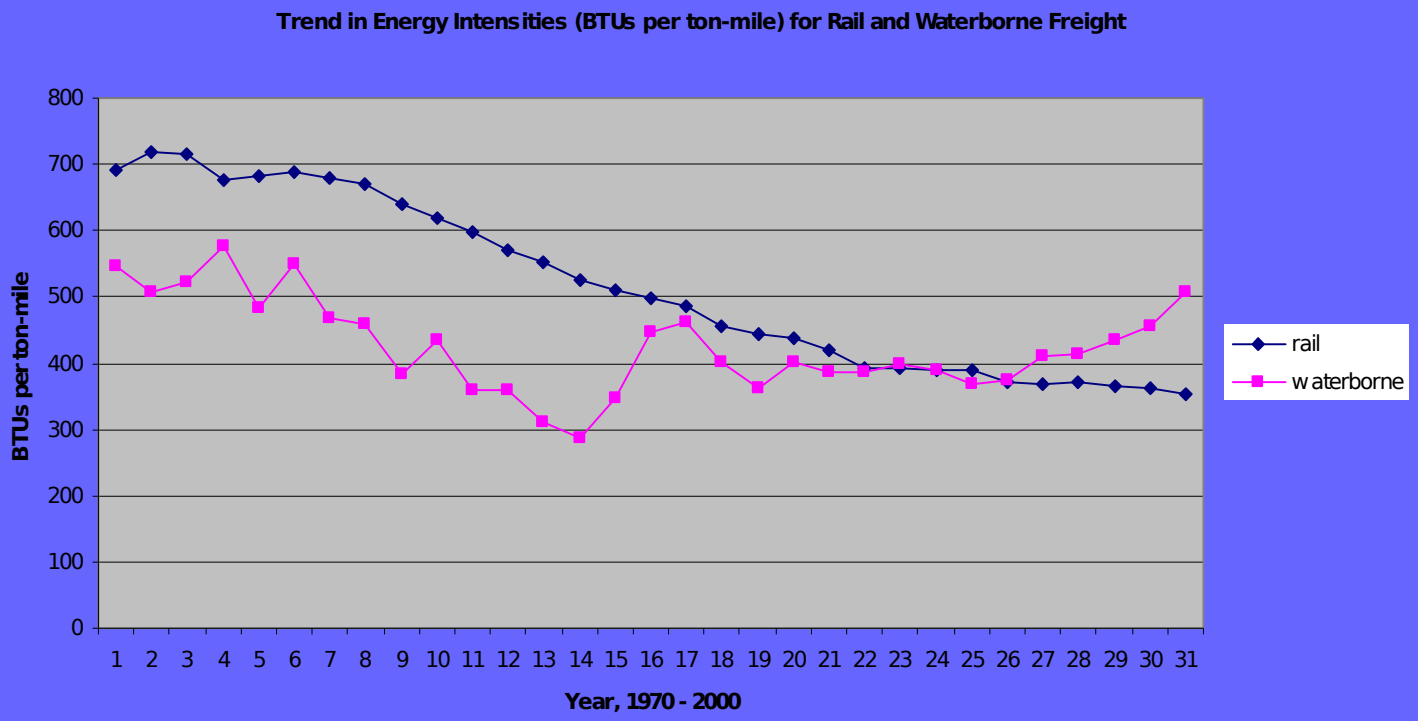
- European Commission White Paper on Transport Policy for 2010
- Active promotion of inland waterways and short sea shipping “Motorways of the Sea”
- Severe congestion on roads is the driving force
- Designing vessels to fit the small waterways

Relative Energy Efficiencies

Ton-miles per gallon. Source: Oak Ridge National Lab

Year	Truck	Rail	Water
1996	49	375	335
1997	52	373	333
1998	46	378	317
1999	45	380	302
2000	43	392	272

Trend: Rail and Water


Trend in Energy Intensities (BTUs per ton-mile) for Rail and Waterborne Freight
BTUs per ton-mile
800
700
600
500
400
300
200
100
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Year, 1970 - 2000
rail
waterborne

Other Sources

- Baumel and Gervais unit train grain movements: 513 to 802 ton miles per gal.
- Tolliver (from Class I Railroad Annual Reports): 317 to 441 ton miles per gal.
- Bray et al, TVA, inland waterways: 229 to 746 ton miles per gal

Conclusions:

Both Water and Rail have huge fuel efficiency advantages over truck transport.

Difference between water and rail is not clear; depends on the specific circumstances

Health Impacts of Air Emissions

- Determine most likely traffic diversions by mode
- Estimate Air Emissions
- Ambient levels/human exposure
- Dose/response – health impacts
- Monetary value of the health impacts

EPA MOBILE Model

- Developed in 1970’s – constantly reviewed and improved since then.
- Estimates air emissions from mobile sources
- Millions of separate sources
- Wide variations in emissions related to different models/vintages, how they are driven and maintained

NAS Review

- Higher resolution needed of spatial & temporal scales
- Estimates do not correspond to field observations
- Being used for purposes for which it was not intended

Particulate Matter – PART5

- A separate model handles this pollutant
- Institute of Transportation Studies concluded that real world PM might be twice as high as PART5 estimates
- Reasons: high emitters, truck idling, hard accelerating

New EPA Model - MOVES

- Multi-scale Motor Vehicle and Equipment Emissions System
- Designed to operate at finer scales, transportation corridor level
- On-board emissions measurement devices will provide more realistic data
- Expected to be operational in fall 2005

Human Health Impacts

- Particulate Matter is the most significant health hazard from mobile sources
- Diesel exhaust particularly bad
- Fine particles inhaled, cause direct damage, also carry toxics into the lungs

National Research Council Review of EPA's health impacts methodology

- Consider proximity of people to diesel exhaust; human exposure may be higher than ambient levels
- Explicitly include uncertainty in the primary analysis
- Accountability – look for direct evidence that improvements in air quality have improved human health

Valuing Health Benefits of Better Air

- $6.3 million per statistical life
- In evaluation of the 2007 Diesel rule, 40% of avoided premature mortalities occurred in people 75 and older
- Should the benefits be adjusted for age?
- WTP studies

Highway Congestion

- Rapidly worsening: TTI found costs of congestion increased X 7 in last 20 yrs.
- Exacerbates other externalities: increased air emissions, increased accidents
- Adverse sociological effects (road rage)
- High costs of truck freight operation
- Decreased reliability and predictability of deliveries

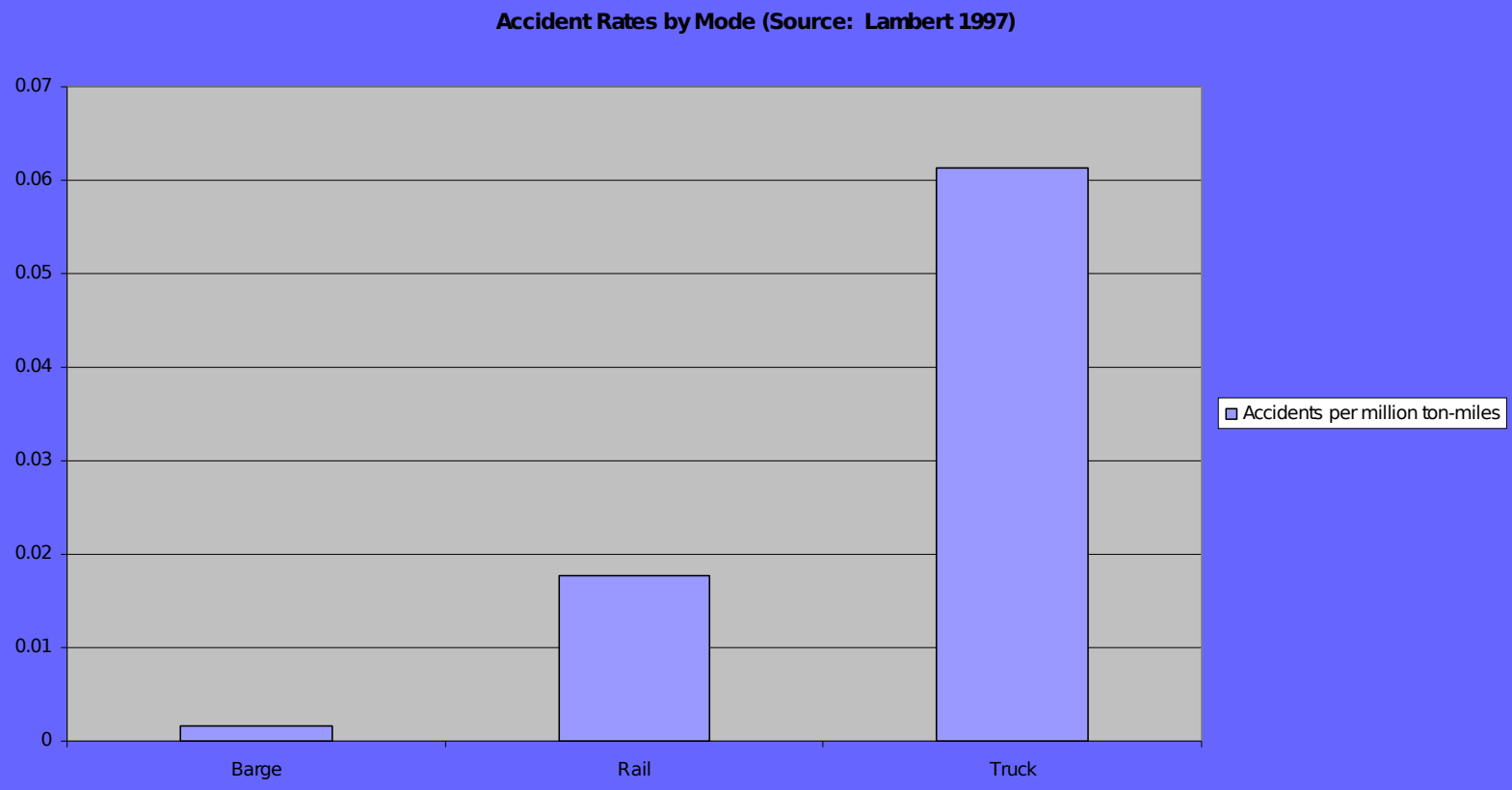
Valuing Congestion

- Texas Transportation Institute annual report
- Two components: delay costs; fuel costs
- In 2001, total cost of highway congestion was $69.5 billion, including 3.5 billion hours of delay and 5.7 billion gallons of excess fuel consumed.

Transportation Models

- VISTA Model – Northwestern Univ.
- Used by Chicago District to evaluate impacts of flood-induced road closures
- Very detailed: runs over the internet on many machines
- Might have application to truck rerouting scenarios for inland waterways projects

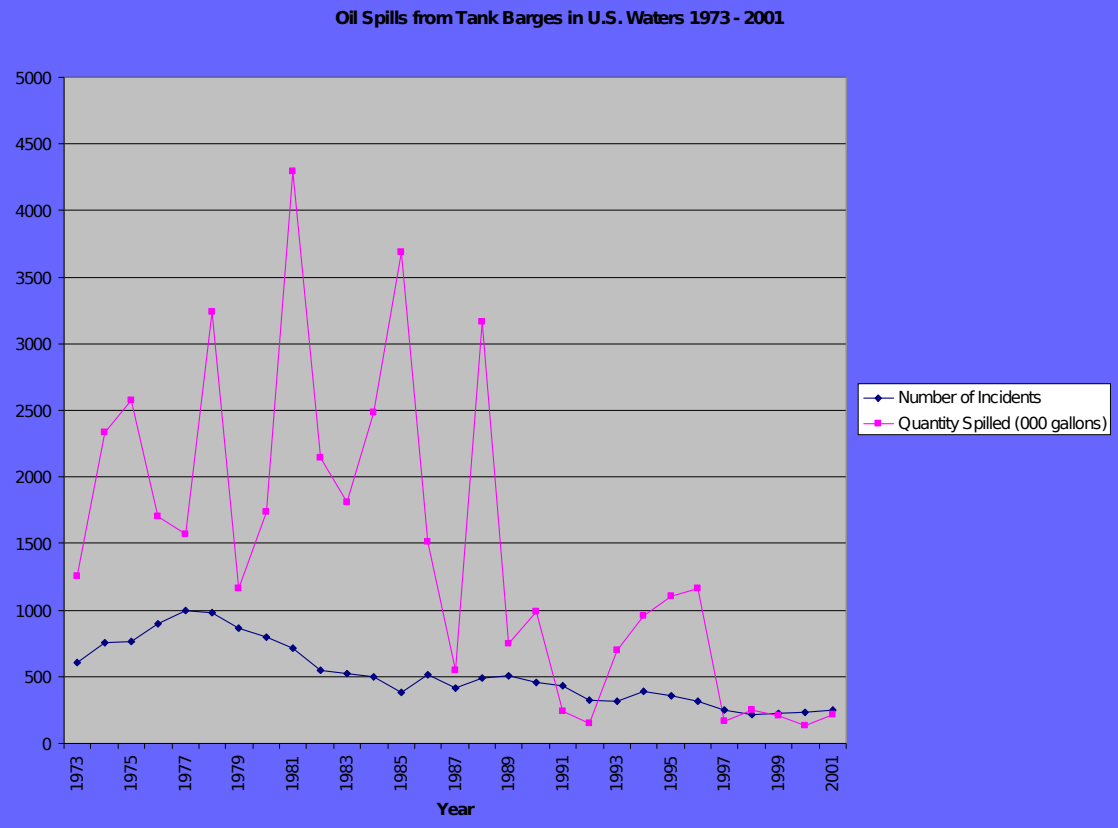
Accident Rates by Mode



Truck Accidents

- Large trucks are overrepresented in crashes
- Most people who die are not truck drivers

Oil Spills from Tank Barges 1973 - 2001



Measuring the Costs of Accidents

- Property Damage
- Injuries
- Fatalities

Costs of Hazardous Spills

- Emergency Response
- Health Care
- Evacuation
- Cleanup
- Contamination of water, air, land

Externalities Specific to Maritime Transport

- Changes in hydrology and consequent impacts on fish and wildlife, flooding, sediment transport
- Impacts of passing vessels (wakes), including bank erosion, sediment resuspension, wave-structure interactions, safety issues

Externalities Specific to Water Transport

- Dredging and its associated impacts
- Exotic species via Ballast Water
  - Zebra Mussels cost $5 billion per year
  - Aquatic plants , hydrilla and water hyacinth control costs $100 million per year

Externalities in the News

- Port of Houston – Wall Street Journal article
- Port of Los Angeles

Future Outlook

- Air Emissions likely going down due to new EPA regulations on all freight modes
- Congestion likely increasing on highways